Dr Wm Thomson —
On Black Expectoration
from the Lungs
Part II
1838

ON

BLACK EXPECTORATION,

AND THE

DEPOSITION OF BLACK MATTER

IN THE

LUNGS,

PARTICULARLY AS OCCURRING IN COAL MINERS AND MOULDERS IN IRON WORKS.

By WILLIAM THOMSON, M.D.,

FELLOW OF THE ROYAL COLLEGES OF PHYSICIANS AND SURGEONS OF EDINBURGH.

PART THE SECOND.

FROM THE TWENTY-FIRST VOLUME OF THE MEDICO-CHIRURGICAL TRANSACTIONS, PUBLISHED BY THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY OF LONDON.

London:

PRINTED BY G. WOODFALL, ANGEL COURT, SKINNER STREET.

1838.

ON

BLACK EXPECTORATION,

AND THE

DEPOSITION OF BLACK MATTER

IN THE

LUNGS,

PARTICULARLY AS OCCURRING IN COAL MINERS AND MOULDERS IN IRON WORKS.

By WILLIAM THOMSON, M.D.,

FELLOW OF THE ROYAL COLLEGES OF PHYSICIANS AND SURGEONS OF EDINBURGH.

PART II.

Communicated by Sir JAMES CLARK, Bart., M.D.

READ APRIL 24TH, 1838.

In a former communication, I had the honour to bring under the notice of the Society a number of instances of black discolouration of the sputa, observed during life, and of black infiltration of the lungs and bronchial glands, ascertained after death, in persons who, from their occupations, were particularly exposed to the inhalation of carbonaceous powders or gases, such as coal-miners and moulders in iron-works. Before proceeding, as it is my intention to do in a subsequent communication, to state the general conclusions, relative to the occurrence of these morbid

appearances in this particular class of persons, which seem deducible from the information that has hitherto been obtained, and to point out those circumstances which still require further elucidation, there are several collateral topics, to which I am desirous to call the attention of the Society.

In the following communication, therefore, I shall, in the first place, briefly recapitulate the observations and opinions respecting black sputa and black deposition in the pulmonary organs, to be found in the writings of authors, previously to the time when the class of cases, to which I have alluded, began to attract attention. This will afford an opportunity of showing that black deposition may occur in the pulmonary organs, independently of the habitual inspiration of an atmosphere, which can be supposed to be peculiarly loaded with carbonaceous matters. The cases of this kind that have been recorded may be arranged under two heads; first, those in which the respiratory have been the only organs affected; and secondly, those in which the black deposition has been met with in a number of different textures and organs of the body besides the lungs. We shall find that much difference of opinion has existed among authors, as to whether the black matter in these two sets of cases is identical or different in its nature; whether, in short, they are all to be regarded as examples of that form of morbid animal production which is denominated melanosis; or whether, whilst the second set fall under that denomination, the first are to be regarded as of a different character. We

shall find also that the opinions of pathologists have widely differed as to whether the black matter, when occurring exclusively in the lungs, should be considered as of extraneous origin, or as generated within the body.

In conclusion, I shall lay before the Society, extracts of communications from gentlemen in different parts of the country, which seem to shew that the phenomena in question are not met with among the workmen in all coal-districts, or even in all the coal-mines of a district some of the mines in which are known to furnish examples of them.

Observations and Opinions of Authors.

The recorded observations and opinions of authors respecting black expectoration and black deposition in the pulmonary organs, I propose to notice in the following order: first, as they relate to the presence of black matter in the expectoration; secondly, as they relate to its presence in the bronchial glands; and thirdly, to its presence in the lungs.

I. THE PRESENCE OF BLACK MATTER IN THE EXPECTORATION.

1. *Notices by authors of this occurrence.*—The expectoration of black sputa, or of sputa containing black specks or striæ, has long been noticed by different medical observers, as occurring in various pulmonary affections, phthisical and asthmatical, as well as in persons apparently enjoying good health. From

their descriptions, however, it would appear that the quantity of black matters which they had seen expectorated was very trifling in comparison with that which occurred in the cases that have been related in my former communication.

Hippocrates [1],* in mentioning the different prognoses to be derived from the appearance of the expectoration, speaks of black sputa as a symptom of danger†. "Perniciem etiam denunciant sputa nigra, fuliginosa, aut quibus qualia ex vino nigro fiunt."

From an incidental notice by Morgagni [2], it would appear, that Salius Diversus, in his Commentaries on Hippocrates, alludes to some cases of persons affected with black spittle, who had fallen under his own observation; but I have not had an opportunity of consulting the work referred to.

Willis [3] makes several allusions to persons voiding, with a slight cough, sputa like black ink, often in a day, and especially every morning, for many months; and states that in some this symptom disappeared on the supervention of a severer cough, attended with a copious expectoration of yellow spittle.

The continued expectoration of black and viscid phlegm in a morning, is mentioned by Morton [4] amongst the signs affording a prognostic of consumption.

* The numerical references are to the bibliographical appendix at the end of the paper.

† Ὀλέθριοι δὲ καὶ οἱ τὰ μέλανα λιγνιώδια πτύοντες, ἢ εἶσιν ἀπὸ οἴνου μέλανος γίνεται πτύσματα.

Haller[5] observes, that black striæ very frequently mix themselves with the pulmonary mucus of adults, and that he had noticed a pigment of this kind in his own sputa from a very early age.

Withers[6], after quoting an observation of Floyers, that the spit of asthmatics is sometimes full of black streaks, adds, that he himself had seen this appearance in many cases of asthma.

It is stated by Portal[7] that there are many persons who, without experiencing any disease of the lungs, discharge by expectoration black matter resembling blood of a very dark colour. He had seen several persons who every morning had in their sputa bodies more or less solid, sometimes round and black, and frequently of a cobweb appearance. Many persons, he observes, have had an expectoration of this kind for a length of time, and even during the whole of their lives, without experiencing any inconvenience; but he had known others in whom it had occurred, who had at last died phthisical.

Dr. Bree[8] mentions that spitting of black mucus is a symptom that often occurs, though not invariably, in asthma as well as in the pituitous consumption; and that he had frequently observed an expectoration of black mucus in asthmatics, when there could be no suspicion of the rupture of any small vessels.

Dr. Pearson[9] remarks, that in a morning, healthy people, after the night's rest, very commonly hawk

up mucous matter of a bluish colour with black streaks; and that persons in a diseased state, especially by great exertions in coughing, frequently expectorate matter spotted and streaked with black particles.

Chomel [10] observes, that the sputa are frequently striped with black in healthy persons who have remained for a length of time in an atmosphere loaded with the vapours of oil or of tallow; but that this phenomenon, though sometimes occasioning alarm, is not indicative of any dangerous consequences.

The only other author whom I have to quote, in reference to this subject, is Laennec [11], who alludes to sputa of a grey colour which many individuals, otherwise healthy, spit up; and to small black points that sometimes present themselves in the transparent bronchial mucus *.

2. *Sources to which the black matter occasionally appearing in the expectoration has been referred.* —With respect to the source and nature of the matter by which black discolouration of the sputa is produced, various opinions have been entertained.

1st. By some it has been supposed to be a secretion from the bronchial glands. 2d. By others from

* I find the following reference in Ploucquet's Literatura Medica, under the article *Sputa Nigra*, but I have not been able to lay my hands upon either of the works referred to. Rubini, in Giornale della Societa, &c., di Parma, Vol. I. No. 2. Vide Harles N. Journ. des Med. Chir. Literatur. B. X. St. II. p. 62.

the glands of the mucous membrane of the trachea. 3d. By others from the exhalents of the pulmonary air-cells; and 4th. By some it has been regarded as of extraneous origin.

1st. Of those who have regarded the bronchial glands as its source, some have believed that it is a natural secretion, and that it is conveyed from these bodies to the cavities of the air-passages, by natural communications; whilst others have looked upon it as a morbid production, and the channels by which it is conveyed, as consequences of disease.

Morton[4] is the first author, so far as I have been able to discover, who attributed its production to the bronchial glands. Senac[12], though he does not allude to black sputa, seems to have considered the secretion of a black fluid as being the proper function of those bronchial glands which are themselves of a black colour: at least during the fœtal state, to which period, indeed, he limited their use in the economy. He states that he had clearly seen the excretory canals by which they open into the trachea, and that when he pressed the glands, a black liquor exuded through these canals.

2nd. The accuracy of Senac's observations was called in question by Morgagni[2], who did not admit the existence of any ducts or channels leading from the bronchial glands to the cavity of the trachea. Morgagni conceived that as there are other glands which evidently discharge their secretion into the trachea and beginning of the bronchia—those, namely, which are situated in the substance of their mucous

membrane, these, and not the bronchial glands, must be the source of the black fluid sometimes met with in the expectoration, or in the cavities of the air-passages.

Haller[5] considered the bronchial glands as belonging to the lymphatic system, and as connected with lymphatic vessels which come from the surface of the lungs and pass through these glands on their way to the thoracic duct. He had not himself been able to discover, nor was he disposed to believe in the existence of any ducts by which they can discharge a fluid into the bronchia. The state of these glands in which they are turgid with a fluid of a deep blue colour, which communicates a dark and almost black stain, and nearly resembles the pigment covering the posterior surface of the iris, except in being of a deeper blue,—he regarded as a peculiar affection occurring in adults. At the same time he conceived that in the cases in which the sputa are striped with black, there must exist passages between the bronchial glands and the bronchi, by which the blue pigment is conveyed from the former to the latter. He mentions Carolus a Bergen, as corroborating Senac's statement of its being possible to press a black fluid out of these glands.

Withers[6] seems to have adopted Morgagni's suggestion that the bluish or grey-coloured phlegm comes from mucous glands in the bronchia, which, he says, are nearly of the same colour.

Portal[7] distinguishes three kinds of black matter as being occasionally contained in the expectoration,

one depending on the inhalation of carbonaceous matter; a second, on a fluid secreted by the bronchial glands; and a third, on blood extravasated into the air-passages. To the first of these, that which is expectorated by persons who have respired for a length of time black emanations, whether of charcoal or of soot, he alludes in only a cursory manner. The two other kinds of black expectoration he treats of in some detail. He gives positive testimony, from personal observation, to the passage of a black fluid from the bronchial glands into the bronchia and trachea, by several openings, when the glands are slightly compressed. The black spit arising from this cause is unattended with danger; and he conceived that it may be distinguished from the third form of black expectoration, which depends on hæmorrhage, and which is almost always attended by fatal consequences, by the circumstance, that when black matters, furnished by the bronchial glands, are thrown into hot water, they are instantaneously dissolved; communicating more or less colour to the water as ink would have done; while the black matter arising from hæmorrhage is dissolved much less readily, is precipitated in the form of a black powder, never very globular, almost always of a cobweb appearance, and scarcely, if at all, colouring the water.

3d. The opinion that the black matter occurring in the sputa, comes from the pulmonary air-cells, originated, so far as I have been able to discover,

with Dr. Bree[8]. "I believe the material which colours the mucus," says he, "to be the carbon of the blood, which in the healthy state of the system, was exhaled in carbonic acid, the atmospheric air having been then properly decomposed. In asthma the system is not sufficiently invigorated with oxygen, and hydrogen holding carbon in solution predominates in the system, and gives to the arterial, too much of the colour and quality of venous blood. An expectoration of this kind may, therefore, be expected, when a very considerable extent of the vesicular surfaces is covered from the contact of air by a coat of serum; but that predisposition of the blood, which leads to the pituitous consumption, as well as to asthma, may at all times favour the appearance." Dr. Bree did not admit that the black colouring matter could in any case come from the bronchial glands, though he seems to think it possible that it may, in some instances, proceed from the glandules which open into the trachea or bronchia.

4th. Dr. Pearson[9] conceived that the black matters observed in the sputa are not of internal but of external origin; that they are in fact the larger particles of carbonaceous vapours with which the air is impregnated, which being inhaled into the lungs, become entangled in the mucus lining the air-vessels, and are rejected from time to time by expectoration. The opinions of this author, it will be necessary to consider more at length in treating of the deposition of black matter in the lungs.

We have seen that Chomel[10] attribnted the appearance in qnestion to the respiration of an atmosphere loaded with carbonaceous vapours.

II. PRESENCE OF BLACK MATTER IN THE BRONCHIAL GLANDS.

From the view that has just been taken of the different opinions entertained by authors respecting the source of the black matters occasionally met with in the sputa, it is obvious how much the explanations that have been given of this phenomenon, have turned on the views entertained respecting the structure and functions of the bronchial glands. We have seen that some authors have supposed that the black matter which is found in the bronchial glands is formed in these bodies and conveyed from them to the air-passages, by natural or morbid communications; but others assign to that matter a course directly the reverse, alleging that it is conveyed from the lungs to the bronchial glands by lymphatic absorbent vessels.

Of those who have entertained the latter of these opinions, some have conceived that the carbonaceous matter with which the bronchial glands are discoloured, originates within the lungs; and others, that it is introdnced into these organs from without, suspended in the atmospheric air which is breathed. The grounds for these two particular explanations will be considered afterwards. At present I have only to advert to the evidence in support of the more

general supposition, that the bronchial glands do not produce the black matter with which they are tinged, but derive it from the lungs through the lymphatic absorbents.

Reisseissen [13] is the first author by whom I find this opinion to have been expressed. He conceives that in the progress of life, the lymphatic vessels of the lungs diminish very much in width, and in the freedom of their communication with the bronchial tubes; and that though they still continue to exercise, in some degree, their proper function of absorbing the carbonaceous matter which is exhaled from the blood into the air-cells, they are unable to convey the matter which they take up, into the general absorbent trunks. Part of it, consequently, he conceived, accumulates in their primary branches and obstructs them; and the portion which is conveyed to the bronchial glands is not taken up by their *vasa efferentia*, as was the case at an earlier period of life, but accumulates in the glands, so as sometimes to occasion their disorganization.

Soemmerring [14] entertained the same view with Reisseissen as to the black matter contained in the bronchial glands being conveyed to them from the lungs by the lymphatic vessels; though differing in the opinion he held respecting its mode of formation. In mentioning the proofs of the action of absorbent vessels in the lungs, he remarks that all anatomists are sufficiently aware that the bronchial glands are filled by a black matter, true pine-soot, particu-

Hlarly among the common people who burn bad tallow or coarse oil, which matter can find its way into the bronchial glands only through the air passages.

Dr. Pearson [9] held that the opinion of the black or dark blue colour generally exhibited by the bronchial glands in adult man, being occasioned by a peculiar secretion in these glands, is palpably erroneous; inasmuch as they are not organs of secretion, but of conveyance of lymph.

He explained the production of these colours by supposing that the lymphatic vessels which arise in the bronchial tubes absorb the coaly matter that is contained in these tubes, and convey it to the bronchial glands.

III. PRESENCE OF BLACK MATTER IN THE LUNGS.

Diemerbroeck [15] seems to have been the first author who made special mention of black discolouration of the lungs. He states that he had found them of this colour in diseased bodies, and particularly in those of persons, who during life, had been much given to the smoking of tobacco.

Haller [16] mentions the case of a man, one of whose lungs "was not indeed purulent, but overflowed with a matter like ink." In another case he had found a similiar black matter in the cavity of the chest.

Morgagni [17] mentions a case in which the lungs seemed as if they had been dyed with ink.

Reisseissen [18] gives the first description I have met with of that form of black deposition in the lungs

which is now well known to occur very generally in persons advanced in years, and in which the deposition assumes the form of striæ or patches. He attributes it to that obstruction of the lymphatic vessels communicating with the air-cells, which, as we have already seen, he conceives to occur in the progress of life, so that in very old people, a large portion of these vessels appears to be inoperative. Accordingly, the black striæ alluded to, are always found on the surface, and in the substance of the lungs of adults, and in greater abundance proportionally with their age; whilst they are not to be met with in the fœtus or very young child. Reisseissen states, that on accurate examination, it is found that this black matter surrounds the small pulmonary lobules, is deposited between the air-cells, and particularly in the spaces in which the lymphatic vessels collect. Hence it is, that they describe mesh-formed striæ around the lobules. He was satisfied, that in these instances, the black matter is contained in the lymphatic vessels; and he looked upon it as established by the analyses of chemists that it is really carbon.

A still more elaborate account of the striated or spotted form of black deposition in the lungs, was given by Dr. Pearson[9]. He states, that at the age of about 20 years, the lungs have a mottled or marbled appearance, from black and dark blue spots, lines, and points disseminated immediately under the transparent pulmonary pleura. "As hath been repeatedly observed," he continues, "the lungs generally become more dark coloured proportionally to their age. Ac-

cordingly, at upwards of 65 or 70 years of age, they often appear almost uniformly black, from the number and congeries, or coalescence of the maculæ, points, and lines just mentioned. Throughout the whole interior substance of the lungs, the black spots are seen, in a great measure corresponding to the external appearance." Dr. Pearson was aware, however, that the quantity of black matter in the pulmonary organs is not entirely according to the age, for in a woman of 75 years of age, residing in London, he found the lungs and bronchial glands not more deeply coloured than is usual at the age of 50.

Reisseissen, as we have already seen, referred to the analyses of chemists as establishing the carbonaceous nature of this black deposition. Dr. Pearson, who was not aware of any observations or experiments having been made to determine its nature or cause, instituted a series of experiments on the black matter obtained from the bronchial glands and lungs respectively, by which he satisfied himself that it consists of animal charcoal in the uncombined state, i. e. not existing as a constituent ingredient of organized animal solids or fluids. "I mean by the term animal charcoal," he observes, "what is popularly understood. Of course I do not mean pure charcoal. Such a state of this substance cannot here be reasonably expected, either from a consideration of the state of it as inspired from the atmosphere, or from its necessary impregnation with animal matter during its long residence in the lungs. I imagine, no person would

hesitate to consider such a coaly substance as the present to be charcoal, if derived from other sources besides the animal economy; it being, as shewn by the experiments related, a black, tasteless, infusible powder, indissoluble in muriatic acid, nitric acid, and perhaps all common acids except the sulphuric; affording as large a proportion of charcoal acid as animal and vegetable charcoal, which has been exsiccated at the same temperature, and equally resisting fire in close vessels."

There is no part of Dr. Pearson's memoir on this subject more creditable to his sagacity, than that in which he has pointed out the grounds of distinction between the black matter found in the lungs, and those other black matters that are found in other parts of animal bodies; and has applied these distinctions to the proof of the black pulmonary matter being of extraneous origin. "The blackness of the lungs from charcoal," he remarks, "remains although hæmorrhage to occasion death has occurred. It is not removable by ablution, or maceration in water, nor by acids, nor alkalies, nor by the early stages of putrefaction. I have not met with a similar coaly substance in any parts of the animal economy except the lungs. The glands of the meso-colon are sometimes black, similar to the bronchial; but the colour soon disappears on immersion in nitric or muriatic acids, no charcoal being separable. The black or more truly the dark-brown tingeing liquid of the sepia, I have ascertained by experiments, does not

contain uncombined charcoal: this matter existing there only as a constituent ingredient of animal matter."

This observation of Dr. Pearson's seems calculated to overturn an argument adduced by Bichat [11] against the supposition of the black colour of the bronchial glands being attributable to their connexion with the lungs. In speaking of the organization of the lymphatic glands generally, and the varieties in their colour, Bichat remarks that the colour is different in different regions of the body. Thus, says he, the bronchial glands have a blackish tinge, partly inherent in their structure, but also owing, probably, to the fluid which they contain, as is proved by the appearance of that fluid when expressed from the divided gland. That this colour does not depend on the vicinity of the lung and the colour of that organ, which is also, as is well known, sprinkled with black spots, he conceives to be sufficiently established by the fact that he had very often found the lumbar, mesenteric, and other lymphatic glands also black. But there is no part, he adds, where this colour is more common than about the lungs. This argument, obviously falls to the ground if Dr. Pearson's statement be correct, that the blackness of the bronchial and that of the other lymphatic glands alluded to by Bichat, depend upon different chemical agents.

As to the source of the carbonaceous matter met with in the lungs, Dr. Pearson alludes to a conjecture as having been proposed, that sooty matter taken in with the air, may be the occasion of the black co-

lour of the lungs; and to the supposed refutation of this explanation, founded on the absence of black discolouration in the lungs of brute animals, and on its presence in persons who breathe the air of the provinces at a great distance from towns, or from places where much coal is consumed. Notwithstanding these objections, he was himself satisfied that the charcoal which is found in the pulmonary organs, is introduced in breathing, with the air, in which it is suspended in invisibly small particles, derived from the burning of coal, wood, and other inflammable materials in common life. The particles of charcoal he conceived to be retained in the minutest ramifications of the air-tubes, or even in the air-vesicles, so as to produce the coloured appearances on the surface and in the substance of the lungs. "Future observations," Dr. Pearson adds, "must determine more satisfactorily the state of the pulmonary organs, according to the impregnation of the air with sooty vapours. If, hereafter, it be shewn that the lungs of persons living remote from sources of such vapours, are still greatly impregnated with coaly matter, the just conclusion can only be that such matter is more extensively diffused through the atmosphere than is apprehended. This being the fact, it would also afford a proof that it is only the invisibly small particles which are absorbed."

Dr. Pearson mentions that in no instance had he observed the lungs and bronchial glands so black, or been able to separate from them so much charcoal, as in those of a person forty-two years old, whose

death was occasioned by most extensively diffused tubercles, many vomicæ, and a considerable condensation of the pulmonary organs. "This subject had been," observes Dr. P., "a smoker of tobacco, generally several times, but always once a day, for perhaps more than twenty years." This observation is interesting in two respects; first, from the confirmation it seems to give to Diemerbroek's statement respecting the lungs of tobacco-smokers; and second, from its being an example of a form of black deposition in the lungs, to which I shall afterwards more particularly allude, in which it occurs in combination with other morbid alterations of these organs.

The coaly matter after being deposited in the lungs, is, Dr. Pearson conceived, very slowly absorbed by the mouths of the lymphatic vessels in the innumerable air-tubes and cells;—an opinion in which, as has been seen, he had the concurrence of Reisseissen and Sömmerring. "When I compared," says he, "the black lines and black net-like figures, many of them pentagonal, on the surface of the lungs, with the plates of the lymphatic vessels by Cruikshank, Mascagni, and Fyfe, I found an exact resemblance." "To determine whether or not this matter exists in the lymphatic vessels, and is the occasion of the black maculæ, streaks, and areolæ, or marbled appearance of the surface of the lungs, these vessels were injected with quicksilver. In some trials, the injection passed, without interruption, in the usual manner; but in others it was apparently obstructed, by meeting with the black lines on the surface. About an inch in

length of one of these black lines, supposed to be a lymphatic vessel, was cut out, and put into a glass capsule full of nitric acid, upon which the black line was immediately contracted in all dimensions; but it retained its form after digestion for several days, at a high temperature: afterwards, on gently shaking the capsule, the black line was broken into a number of indissoluble particles." "Hereafter," Dr. Pearson suggests, "among other inquiries, the colour of the large trunks of the lymphatic vessels, just before they enter the bronchial glands, and just as they pass out to them, ought to be observed."

The authors to whose opinions relative to the presence of black matter in the lungs I have next to call attention, are the three distinguished French pathologists, MM. Bayle, Laennec, and Andral, whose labours have contributed so materially to the advancement of medical science. The writings in which they are recorded were, it must be remembered, published subsequently to the recognition of melanosis as a distinct morbid product; and accordingly the object which they have had principally in view has been to determine the relations of black discolouration of the lungs to melanosis.

In 1810, M. Bayle published at Paris his work entitled "Recherches sur la Phthisie pulmonaire." Among the six species of this disease which he endeavoured to establish, M. Bayle included that of "phthisis with melanosis." In the account which he gives of this species, he mentions that it is not very rare in its occurrence, and that prior to his

own time it had frequently been seen by authors, without their having given a distinct account of it. He has not, however, given any references in support of this remark or statement.

Without at present entering on the question whether the cases to which Bayle refers were really of the nature of melanosis, I shall endeavour to give the general results of his observations respecting the particular form of pulmonary affection described by him under that name.

According to Bayle's observation, melanotic phthisis attacks only adults, and particularly those advanced in life, seldom occurring in persons under fifty years of age. In the lungs of those who die of this affection, M. Bayle had found ulcerations (cavities?) of greater or less extent, with parietes as black as charcoal. These parietes were very hard, sometimes a few lines and sometimes even a few inches in thickness. The parts at a distance from the ulceration he had observed to be usually very healthy: but if the disease affected a whole lung, it was hard, compact, and as black as ebony or charcoal, sometimes resembling half-burned leather.

Respecting the symptoms of this form of phthisis, M. Bayle remarks that it is frequently of long duration, and that it in general goes on for a great length of time, without producing any alarming symptom. The patients have a moderate cough accompanied with white or whitish sputa, which do not always appear to be of a very bad character. These sputa, M. Bayle farther describes as being generally round and

somewhat opaque, and as being almost always expectorated along with a pretty considerable quantity of thinnish phlegm: if the expectoration does not consist in part of a pituitous matter, the sputa alluded to are very consistent, but they swim in water in place of sinking to the bottom of the vessel. I quote at length these observations of M. Bayle, respecting the character of the sputa in melanotic phthisis, in order to shew that no allusion is made by him to the occurrence in this disease of any black discolouration in the expectoration.

When this form of phthisis is simple, that is to say, unaccompanied by any other morbid alteration in the structure of the lungs, the patients, according to M. Bayle's observation, experience scarcely any uneasiness in the chest, and merely complain that the cough prevents them from sleeping; they lose flesh slowly, and their pulse is in general a little more frequent than ordinary. Even in the latter periods of life, some patients affected with this disease, though in a state of extreme marasmus, and frequently expectorating copiously, seem to be scarcely indisposed; and in some the malady does not assume a serious aspect till within a few days of their death. During the latter months of their illness they usually become subject to œdema of the limbs, but this in general yields readily to proper treatment.

But melanotic phthisis, according to M. Bayle's observation, is more frequently complicated with tubercular phthisis than simple, the tubercles, however, being few in number. It is also, he observes,

sometimes combined with granular phthisis, as well as with some of the other species of phthisis which he has described. He remarks that in general when melanotic phthisis is complicated with another species, the complication accelerates the death of the patient, and the altered portions of the lung are less black and less hard than in cases of simple melanotic phthisis. But if it be with granular phthisis that it is complicated, the death of the patient is little accelerated by the complication, and the parts of the lungs affected with melanosis become very hard and very black.

For the illustration of this form of phthisis, M. Bayle relates seven cases. In two of these, that of a surgeon 52 years of age, and that of a hair-dresser of 69, the melanotic phthisis was simple. In three it was combined with tubercles. The subject of one of these cases was a hair-dresser of 62; that of a second, a dealer in tobacco, of the same age; and that of the third, an African negro, a house servant, only 25 years old. Lastly, in the other two cases, the melanotic affection was complicated with what M. Bayle called granular phthisis. The subject of one of them was a woman 72 years of age, and that of the other, a perfumer of 48.

In four of the cases related by Bayle, the two in which the melanotic phthisis was simple, one of those in which it was combined with tubercle, and one in which it was combined with granular phthisis, the deposition of black matter was very considerable, and the lung had acquired a very black colour. The

three other cases presented only the first shade of melanosis, the portions of lung that were altered being much less black than they would have been if the melanosis had reached its last degree.

From this review of M. Bayle's cases of phthisis with melanosis, it is of importance to be kept in view that in only one of these cases does there appear to have been any trace of black discolouration detected in any other part of the body besides the lungs; and in that case, in which there co-existed tubercule-melanotic lung and scirrhous stomach, the black discolouration was confined to spots on different parts of the peritoneal coat of the intestines. Every anatomist knows, however, that this is a situation in which similar black spots are frequently met with, when there are no traces of melanosis in any other part of the body.

In comparing Dr. Pearson's description of the black discolouration of the lungs with M. Bayle's account of melanotic phthisis, it is impossible not to be struck with this difference in the views which these authors respectively take; viz. that M. Bayle regards the black matter met with in the lungs as a product of morbid action, and consequently as generated within the body, whilst Dr. Pearson considers it as independent of disease and as being introduced into the lungs from without along with the air in respiration. The question, therefore, naturally suggests itself, whether the black matter in the two classes of circumstances in which it was observed by these authors, is identical in its nature;—whether in

either of them it can be regarded as of the nature of melanosis, or how many different sources there may be of black discolouration of the lungs.

Since the publication of Dr. Pearson's paper, pathologists have very generally allowed that there does occur in the lungs a black discolouration depending upon a cause different from melanosis; but opinions have been considerably divided as to the cases in which the discolouration should be considered as of a melanotic nature, and those in which it should be attributed to a different cause.

M. Laennec, in his Work on Mediate Auscultation, published originally in 1819, treats of melanosis of the lung and black pulmonary matter, as distinct in their nature and effects. His account of black pulmonary matter, as distinguished from melanosis, corresponds very much with that of Dr. Pearson, to whom, however, he does not refer.

The black pulmonary matter, according to M. Laennec, exists so commonly in the lungs, even of the most healthy persons, that we can scarcely consider it as a morbid production. We find more or less of it in the lungs of almost every adult; and its quantity seems to increase in proportion with the age of the individual. In infancy, we generally perceive no trace of it; and the lungs at this age have as pure a rose colour as those of oxen and many other animals. He thinks it possible that the black matter may exist only in man and carnivorous animals, but professes himself not sufficiently versed in comparative anatomy to advance any thing with cer-

tainty on this point. With respect to its origin, M. Laennec professes to have often thought that this black matter might arise, in part at least, from the smoke of lamps and other combustible bodies which are used to afford heat and light, for from the examination of the bodies of several old persons, whose lungs contained little of the black matter, and whose bronchial glands were only slightly tinged with it, he had been led to suspect that it is generally in villagers, who are seldom in the habit of sitting up late at night, or consequently of employing artificial lights, that this kind of matter is found to be wanting. He admits, however, that the black matter is sometimes found in very small quantity in persons not accustomed to late hours.

When the black matter exists only in small quantity, M. Laennec remarks that it imparts to the lungs merely a slight greyish tinge. Towards the surface of the lungs it is disseminated in small black points, which, being more numerous and more thickly set along the intersections of the pulmonary lobules, form there striæ, small spots, or dotted lines. If these points be closer set, either at the surface or within the substance of the lungs, they form spots more or less numerous and extended; sometimes they are sufficient to give a black colour to large portions of the lung, but without altering the pliancy or the permeability of its tissue.

M. Laennec farther remarks, that it is principally in the bronchial glands that this black pulmonary matter is found in considerable quantity. In adult,

and particularly in old persons, these glands are frequently as black as ink ; but in other subjects they are only partially stained with this colour, which appears as if irregularly applied with a brush. We can scarcely regard, he conceives, so common an appearance as morbid, the more so that it is met with in a multitude of subjects in whom there occurred during life neither cough, dyspnœa, nor any other symptom which could indicate it. This colour of the bronchial glands seems merely to produce the grey colour of the bronchial mucus which many individuals, otherwise healthy, spit up, and those small black points that sometimes present themselves in this transparent mucus.

M. Laennec had observed that the development of tubercles in the lungs, and especially the cicatrisation of tubercular cavities, frequently gives rise to an increased secretion of the black pulmonary matter. Sometimes the quantity of this is so great that, joined to the state of condensation which the texture of the lung undergoes, from the development of tubercles, of cartilaginous cicatrices, and of the cretaceous deposit that accompanies them, the part of the lung so affected becomes impermeable to the air, and at the same time there results a flaccidity of its tissue accompanied with a hardness equally well marked. This, however, seems rather to be owing to accidental cartilaginous and osseous productions than to the black matter itself.

Such is the general description given by M. Laennec of the black pulmonary matter. In regard to

the occurrence of true melanosis in the lungs, M. Laennec expresses his belief, that it is very rarely met with in these organs, and that M. Bayle had in some instances confounded black pulmonary matter with melanosis. He acknowledges that these two substances resemble one another very much in their external characters, and doubts whether the most practised eye could distinguish between a portion of melanotic structure from the liver or any other organ, and a bronchial gland entirely black, such as is often met with when the lungs themselves are very healthy; but he mentions the following characters as those by which one might be led to suspect some difference between the two substances. 1st. Softened portions of melanosis, and even the matter which exudes on pressing a portion that is still firm, stain the skin black, but this colour is very easily removed by washing; whilst the matter expressed from black bronchial glands takes such a hold of the skin, that, if we allow it to dry before attempting to remove it, it remains attached to this texture for several days. 2nd. In respect of chemical composition, he alleges that there are very essential differences. The bronchial glands contain, according to Fourcroy, a large quantity of carbon and hydrogen, but these principles are not met with in portions of melanotic substance which is almost entirely composed of albumen, and its colouring matter is of a peculiar nature. 3d. Melanosis produces all the local injurious effects of other forms of cancer, and is frequently found combined with one or with several other species of morbid

productions in compound cancerous tumours. M. Laennec adds, that when melanosis occurs in masses of some size, or is infiltrated into the pulmonary texture in such quantity as to give to it a deep black colour, and a consistency equal to that of liver, it may easily be recognised; but when it exists in the form of incipient infiltration, and is in too small quantity to harden in any sensible degree the texture of the lungs, it is difficult to distinguish it from black pulmonary matter.

In addition to these characters, in respect of which M. Laennec formally contrasts black pulmonary matter and melanosis, there are other, as he conceives, distinguishing circumstances, to which he adverts in the course of his description. Thus, 1st, according to his observation, the black pulmonary matter does not alter the pliancy or permeability of the pulmonary tissue, while the infiltration produced by the matter of melanosis has this effect. 2nd. In cases of the deposition of black pulmonary matter, the mucous secretion from the bronchia is of a greyish tinge, or intermixed with small black points. When melanotic matter is developed in the lungs, even in a great degree, it does not give rise to black expectoration, except perhaps at the moment when the melanotic matter, after having been softened, is discharged into the bronchia. At the same time, M. Laennec admits, that in extreme cases of combination of tubercular, cartilaginous, and cretaceous induration of the lung accompanied with black deposition, it is difficult to ascertain whether the colour and density

of the part affected depend on infiltration of the black pulmonary matter, or of the proper matter of melanosis. But in the majority of cases, he alleges, we can easily make the distinction, and the rules which he lays down as to be observed in drawing this distinction, are the following. 1st. We must not admit the existence of melanosis in the pulmonary tissue unless we find masses of it, of some size, and already softened; or at least so situated, and of such a shape as that it shall be quite impossible to confound them with the bronchial glands. 2nd. We must not admit the black matter with which the pulmonary texture is infiltrated to be of the nature of melanosis, unless it be to such an extent as to give it a density and hardness equal to that of liver; but if the lung be flabby, and its hardness owing to osseous and cartilaginous depositions, we must regard the black colour as produced simply by black pulmonary matter.

To illustrate his views as to the distinction between true melanosis occurring in the lungs and black pulmonary matter, M. Laennec has subjoined two cases, one of general melanosis in which the lungs participated in the disease; the other of imperfect cicatrices in the lungs, mixed with cartilaginous and cretaceous productions, with an accumulation of black pulmonary matter. In the first of these cases, which occurred in a woman 59 years of age, a cook by occupation, M. Laennec remarks, that no doubt can exist as to the nature of the black tumours observed in the lungs. The coexistence of similar tumours in different parts of the body, and the absence of the black

colour in the bronchial glands themselves, remove all doubt upon this subject. But in the second case, on the contrary, which occurred in a man of 60, whose occupation is not mentioned, several circumstances combine to render it difficult to determine whether the black colour of the indurated portion of lung depended on the accumulation of black pulmonary matter, or on the infiltration of the matter of melanosis. M. Laennec expresses his belief, however, that cases seldom occur in which there is so much room for doubt; and he regards it as not the less certain that, though difficult to distinguish from the black matter of the lungs in some particular cases, melanosis is a production entirely different from that matter.

In expressing his belief, that M. Bayle in establishing melanotic phthisis as a particular species, had not sufficiently distinguished between melanosis of the lung and black pulmonary matter, M. Laennec remarks, that in place of the progressive emaciation and hectic fever, which are the most constant symptom of tubercles developed in the lungs, melanotic affections have for their principal effects, the tendency to cachexia and anasarca, and most frequently occasion death before having produced a very marked degree of emaciation. The persons whom he had seen die in consequence of the development of melanosis in any organ, and those, too, in whom this matter occupied a large portion of the lungs, had no continued and well marked fever. The two observations of simple melanosis of the lungs contained in

the work of Bayle, furnish a similar result. If this character be constant, as he was disposed to believe, it might enable us to distinguish, during life, between consumption produced by melanosis of the lungs, and tubercular phthisis, which, as is well known, is constantly accompanied, during almost its whole duration, by a hectic fever, pretty generally characterised by two exacerbations, one occurring about mid-day and the other during the night. The most constant local effects of melanosis developed in the lungs, are, adds M. Laennec, a dyspnœa proportional to the extent of the affection, and a cough, frequently dry, but sometimes accompanied with a pituitous affection, very generally mixed with some purulent sputa.

But whilst M. Laennec regarded the black pulmonary matter and melanosis as two different productions, capable, though with difficulty, of being distinguished from one another, M. Andral [19] took a different view, maintaining that, in all instances, the black matter is the same, and that the diversities in other respects depend on the presence or absence of other forms of disease. This author remarks, that the black induration of the lung has been regarded as the result of the infiltration of its tissue by a matter of new production, by melanosis, this matter being supposed to be united or combined, particle to particle, with the texture of the organ in which it is developed. He acknowledges that, in a certain number of cases, the colouring matter which constitutes melanosis, may be deposited in each of the meshes or areolæ of the parenchymatous structure, and as-

sume a solid consistence, giving to the parenchyma an appearance of induration, just as it may form a solid deposit in a circumscribed spot, and constitute there a melanotic mass or concretion. But he thinks it can easily be shewn, that in most cases in which an organ is at the same time indurated and coloured black, the induration is independent of the black colour, and is the simple result of chronic inflammation. This he considers to be particularly the case in the black induration of the lung, or what has been called melanotic phthisis; inasmuch as the same induration of the pulmonary parenchyma is met with of all possible colours, red, light grey, dark grey, and slate-coloured. In some cases, he remarks, we may trace, on the same lung, the insensible transition from the grey tint to the deepest slate colour, the lung being in all parts equally indurated. The symptoms assigned by Bayle to this species of phthisis are besides, M. Andral alleges, absolutely the same as those which belong to every induration of the pulmonary texture.

Whilst M. Andral, accordingly, regards the melanotic phthisis of Bayle, or the black induration of the lung, as a form of chronic pneumonia with the addition of a colouring matter, he thinks we may conceive cases in which the black pulmonary matter may be formed without the texture in which it originates having been previously indurated, though the occurrence of black unindurated lung could not be admitted by those authors who regarded the induration as owing to the presence of melanosis. Instead,

therefore, of regarding, with M. Laennec, melanosis of the lung and black pulmonary matter as two distinct forms of production, M. Andral conceives the only difference to be, that in the one case, the discolouration coexists with an induration resulting from chronic inflammation, whilst in the other case it exists without induration.

The black induration of the lung, M. Andral states, has been observed at all ages of life: he has seen it occupying the whole upper lobe of the left lung in a girl nine years of age, and has frequently found it in persons under thirty. At the same time he admits that it is in old people that chronic pneumonia is most frequently accompanied with black discolouration, as if the disposition to the formation of tubercles, so decided in youth, were replaced, at a later period, by the disposition to the secretion of black matter. He further points out, as a remarkable circumstance, that when the black matter is very abundant, and the lung at the same time contains tubercles, there seems in some instances to be a tendency in these to heal, or at least their development appears arrested; as seems to be indicated by their cretaceous appearance, and their tendency to be changed into stony concretions.

M. Andral thinks that this black discolouration may result either from a simple modification which the blood undergoes in consequence of its remaining long stationary in the textures; or perhaps from the secretion of a particular colouring matter which is produced in different textures, under the influence of an

inflammatory process, as it is formed naturally in the choroid coat. He makes no allusion to the supposition of its ever being of extraneous origin *.

In 1826, my late lamented friend, Dr. F. W. Becker, published, at Berlin, an inaugural dissertation "de Glandulis Thoracis Lymphaticis," &c., in which he strenuously opposed the notion, entertained by Laennec, of the black matters found in the expectoration, or in the substance of the lungs or bronchial glands, being of extraneous origin. Professing to adopt the views which had been taken by Heusinger, in a work published a few years before, and entitled "Researches on the Accidental Production of Pigment and Carbon in the Human Body, considered particularly in relation to melanosis, the predominance of the venous system, yellow fever, and the atra-

* In the addition of M. Laennec's Work on Auscultation, lately published under M. Andral's superintendence, he has in a note referred to the "observations recently made in England, which do not allow us to doubt that, in a certain number of cases, the black colour of the lung is owing to the habitual and continued inspiration of an air loaded with particles detached from bodies also of a black colour, as for example with charcoal." After adducing some of the cases of this kind which have been published, M. Andral adds: "These facts had already attracted my attention, when M. Behier, élève interne at the Hôpital de la Charité, presented to me a drawing which he had made of a lung wholly coloured black, like those of which the English authors speak, and found also in a person who habitually respired an air loaded with the dust of charcoal." This case, along with a plate representing the "black, and as it were, carbonized lung," M. Andral has inserted at the end of the third volume.

bilious diseases of the ancients," Dr. Beeker endeavoured to connect the appearances above referred to with a deficiency in that decarbonization of the blood which it seems a main purpose of the function of respiration to effect. "It is well ascertained," says he, "that pulmonary respiration carries off carbon from the body; but it is still doubtful in what way the carbon comes into contact with the air; whether the oxygen of the atmosphere acts on the blood through cells, or reaches the carbon in any other way. The change that occurs can only be explained by supposing a double action,—the one, that of the blood expelling and secreting its carbon; the other, that of the oxygen of the atmosphere carrying this carbon off when it has been secreted, whether we suppose the carbon to present itself in a solid or in a gaseous form. Now it may easily happen that this double process shall go on unequally; that the blood may secrete a larger quantity of carbon in the lungs than the oxygen can receive and convert into carbonic acid. In this case, the excess of carbon is thrown down, or precipitated, as chemists say, in the form of the black matter of which we are speaking. Whence it must necessarily happen, that in those parts of the lungs which are every where pervious to the oxygen of the atmosphere, it will be secreted (thrown down) sparingly; but in those where the access of the oxygen is impeded, in greater abundance. This also appears from the circumstance that in old people the black matter is seen principally in large spots on the surface—that is to say, where the

air could not reach it, but rarely in the parenchyma itself. But the same production of carbonaceous matter which occurs in the parenchyma of the lungs, (or its common cellular texture,) takes place also on the surface of the mucous membrane of the bronchia, and this is the cause of the black discolouration of the sputa."

If we suppose the origin of the black matter in the lungs to be such as has been now described, it remains to be inquired, whence that found in the bronchial glands arises. Dr. Becker suggested two ways in which this might be accounted for; 1st, as some have supposed, it may be transmitted from the lungs by the lymphatic vessels; or, 2d, it may be produced in the glands themselves by a similar process as in the lungs. The first supposition appeared to him unsatisfactory, for he thought it improbable that such a matter, more or less solid, should be taken up by the lymphatic vessels, and conveyed uniformly to the same glands, and, as it appears, no farther, whilst this matter has never been seen in the vessels themselves, and he had himself in vain looked for it.

As to the possibility of the black matter originating in the bronchial glands themselves, Dr. B. gave the following explanation:—"I have assumed above, an inherent power in the blood, by which carbon is excreted in the lungs; which power, though originally prevailing in the lungs, manifests itself also in the neighbouring parts; and among these there are none which seem more suitable for a secretion of

this kind than the bronchial glands, inasmuch as they receive a larger quantity of blood, and retain it longer in their vascular apparatus, than all other textures." Whilst he admitted that the bronchial glands, properly so called, and the pulmonary glands, are most frequently and plentifully filled with black matter, Dr. Becker stated that he had seen this repeatedly also in the œsophageal glands, which do not receive any lymphatic vessels from the lungs by which the black matter could have been conveyed to them.

Lastly, as he conceived melanosis to result from a morbid exercise of that same power by which carbon is excreted from the blood, he could not concur with Laennec in the distinctions which he had established between black pulmonary matter and melanosis.

It is impossible to overlook the coincidence in the sentiments expressed by Dr. Becker respecting the source of black pulmonary matters, and those which we have quoted from Dr. Bree relative to the occurrence of black matter in the sputa.

" The efforts which M. Laennec makes," says M. Meriedec Laennec, in a note to a posthumous edition of his work, " to establish a difference between melanosis and black pulmonary matter, have not prevented this distinction from being generally rejected. Most anatomists of the present day are disposed to consider melanosis not as an accidental production in the sense attached to that expression by Laennec: it is to be considered only as a sort of impregnation of a normal or accidental texture, healthy or diseased, by a particular colouring matter. There is not conse-

quently, and cannot be any difference between black pulmonary matter and melanosis, properly so called; if it be not that in the former case the colouring matter is deposited in a healthy tissue, whilst in the second it impregnates a morbid or accidental tissue. In the softening of melanosis, therefore, we can recognize only the softening of textures with which the black colour is combined."

It seems singular that in these recent discussions as to the identity or non-identity of black pulmonary matter and melanosis, so little reference should have been made to chemistry as calculated to throw some light upon the question. Dr. Pearson had pointed out some important differences between black pulmonary matter and the natural black animal pigments, viz., the pigmentum nigrum of the eye and the dye of the cuttle fish, particularly as regards the reagents capable of dissolving them, and the action of certain reagents upon their colour. If these characters are sufficient, as Dr. P. conceived, to establish a positive distinction between the two classes of substances, then it is obviously an essential preliminary to any judgment as to the identity of black pulmonary matter and melanosis, to determine whether there is an identity in their chemical relations, or whether melanosis corresponds in its chemical characters with the natural pigments above alluded to. Several analyses of the substance of melanosis have been published; but in most, if not all of these, with the exception of Dr. Henry's, the chemists seem to have contented themselves, in so far as the colouring prin-

ciple of black matter is concerned, with establishing an analogy between it and the colouring matter of the blood, without particularly adverting to those circumstances by which its correspondence with the natural pigments on the one hand, or with black pulmonary matter on the other, must be determined. I shall here insert the results obtained by Dr. Henry [22] from the examination of a portion of softened melanotic matter, after it had been kept some time in spirit, which seem to establish its resemblance to the natural black pigments rather than to the black pulmonary matter as tested by Dr. Pearson.

1st. By filtering through paper, much of the colouring matter remained on the paper, and the colour of what passed through was much less intense.

2d. Boiling does not destroy the colour; not even when a little caustic potass has been added.

3d. It is not changed by acids even when heated, except by nitric acid, which deprives it of its black colour and turns it yellow.

4th. A stream of chlorine passed through the liquid destroys the black colour, and throws down light fawn-coloured flocculi.

5th. A few grains of corrosive sublimate stirred up with the fluid, precipitates the whole of the colouring matter, and leaves the supernatant liquid quite clear.

6th and 7th. Nitrate of mercury and muriate of tin produce the same effect, but more slowly.

"From these experiments, it appears," concludes Dr. Henry, "that the black matter (of melanosis) is a

peculiar secretion, analogous in some properties, especially in the 5th, 6th, and 7th, to the colouring matter of the blood. It would be necessary, however, to repeat and extend the experiments on a larger quantity of the fluid, and in a more recent state, before any just conclusion can be deduced respecting its nature."

It is obvious that if Dr. Pearson be correct in his position, that black pulmonary matter differs in its chemical properties from any of the animal secretions with which he compared it; and if, on the other hand, melanosis corresponds with these animal secretions in its chemical qualities, as Dr. Henry's analysis would seem to shew, this proof of the distinct nature of black pulmonary matter and melanosis cannot be overturned by any arguments, however ingenious, that can be adduced in support of their identity.

The opinion of M. Laennec with regard to the distinct nature of melanosis as occurring in the lung, and black pulmonary matter, has been defended in this country by Mr. Fawdington[22]. "It is necessary," says that gentleman, "to distinguish the morbid appearances of melanosis from the natural black pulmonary matter, which is found more or less abundant in all adults, and which appears to increase with age, sometimes to such an amount as to render the lungs nearly black. In this case, the permeability of the pulmonary tissue; the uniform dissemination of the black matter; its chemical composition; the deep grey or blue-black tint, which a secretion of it exhibits, in contradistinction to the red-brown of mela-

nosis, and the exemption of other textures, are characters upon which we may probably found a correct discrimination. In melanosis, not only is the substance of the lung affected, and the black matter distributed *en masse*, or in an encysted state, but their coverings often participate, and shew the disease in a particular form." To illustrate the difference between these two conditions of lung, Mr. Fawdington gives two delineations, figs. 1 and 2, Plate VIII.

In attempting to form a judgment as to whether, in those cases in which the lungs are exclusively the seat of black infiltration, this be or be not of the same nature as the matter of melanosis, we are naturally led to inquire what physical appearances melanosis exhibits in the lungs, in cases in which it occurs at the same time in other organs of the body, and in which consequently the melanotic character of the pulmonary degeneration seems fully established. For the elucidation of this point I have brought together the descriptions of the appearances presented by the pulmonary organs in those cases of general melanosis that have been put upon record, as far as these have fallen under my notice.

1. In a case of this nature, which occurred under Dr. Home, in the Royal Infirmary of this city[20], there were clusters of tumours resembling purple grapes on the right lung; the lungs were extensively beset with these tumours; and several of an exceedingly small size were detected under the mucous membrane of the bronchia.

2. In another case of general melanosis which oc-

curred in the Royal Infirmary of Edinburgh, under Dr. Alison [21], it is mentioned that within the thorax, a number of small black tubercles were situated on the surface of the pleura costalis, and others of larger size were attached to the surface of the lungs; all of them appeared enveloped in a slender cyst; the substance of the lungs was dark, and some minute tubercles were imbedded in it.

3. In Mr. Fawdington's case of general melanosis [22], there were seen lying upon the lungs a great number of circular or oval flattened tubercles, included in a fine transparent cyst, and attached by a slender hair-like pedicle to the subjacent membrane. In some places these tubercles were congregated so as to resemble clusters of dried currants; and in others, in which the filamentous attachment was especially observable, the tumours were insulated. The corresponding portion of the pleura was likewise dotted interstitially, and was a little raised by the melanose bodies situated beneath it. The pulmonary substance was crepitous, and had undergone no other change than in being the seat of a lightly scattered deposition, which imparted to it a carbonaceous appearance; and here and there, though not in large quantity, the matter of melanosis was distributed in an encysted form.

4. In M. Laennec's case of melanosis developed in a great number of organs [23], the lungs, which were of a rosy colour, presented some small melanotic tumours, but towards their basis and around the bronchial glands, there were found a great number of

a much larger size; the glands themselves were not black.

5. In a case of universal melanosis described by Schilling[24], it is mentioned that a great number of black tumours, of the size of a pea, were seated on the surface of the pleura pulmonalis and of the pericardium; nor was the parenchyma of the lungs free from them, but they were few in number, in this situation, and the texture of the lungs around them was healthy. There were some pounds of blackish water in the cavity of the thorax.

6. In another case, in which melanosis was conjoined with fungus medullaris, Schilling[25] mentions that there was a little yellowish water in the cavity of the chest. The lungs nowhere adhered. On their surface, there was, everywhere, a number of eminences, distinguished from the parenchyma of the lungs by their blackish colour. When the substance of the lungs was accurately examined, it appeared to be wholly beset by morbid degenerations of two kinds; 1st, round bodies of the size of a pea or of a bean, of a bluish-black colour passing into brown, more obscure externally, more distinct towards the centre. These bodies were of the consistence of the kidney or liver, and were obviously surrounded by a cyst copiously provided with vessels, and easily separated from the substance of the lung. The tumours of the second kind were seated deeper in the pulmonary tissue, towards the ramifications of the bronchia, less numerous but of a larger size than those of the first kind, being about equal to a walnut or chestnut.

These tumours, also, could easily be separated from the healthy structure of the lungs, and when cut into, were found to consist of two substances, an inner, forming as it were the nucleus, mostly soft and of a yellow-grey colour; and an outer, of the consistence of the kidneys, reddish and furnished with blood-vessels; but where the tumours adjoined the texture of the lungs, a stratum of black pigment was deposited, which, on separating the tumours from the pulmonary substance, adhered partly to the one and partly to the other. The tumours were most numerous in the inferior lobes of the lungs.

7. In a case described by M. Alibert[26], under the name of *cancer melané*, it is stated that the lungs, which in respect of colour shewed no mark of disease, contained, however, some small tubercles, enough to entitle us to say that they were affected with tubercular phthisis. But around the bronchial glands, in the substance of the mediastina, between the pleura and the internal surface of the ribs, black tumours were found in abundance.

8. In a case described by M. Lobstein[27], it is mentioned that the lung contained a number of small hard tubercles, of the size of a lentil, without the parenchyma of the viscus being thereby altered.

9. In M. Chomel's case of general melanosis[28], all that is stated respecting the chest is, that the lungs presented, towards their summit, some portions of melanosis.

10. M. Lobstein[29], in narrating the particulars of another case of general melanosis, mentions that a

very considerable melanotic tumour occupied the inferior lobe of the right lung. The matter which was contained in it was fluid, and as black as the ink of the sepia; it was infiltrated into the pulmonary parenchyma, which was altered and reduced into a filamentous texture. On minute examination, these filaments proved to be merely arteries and veins, washed with the melanotic fluid, and also containing it in their canals.

In none of the first eight of these cases does it appear that the lungs bore any resemblance to those described by Bayle as affected with melanotic phthisis. None of them can be regarded as cases of infiltrated melanosis. In all, the black matter formed tubercles and small tumours, which, in most of the cases at least, are described as having been encysted. In the ninth case, the state of the lungs is described too vaguely to enable us to form a judgment on this point. The tenth and last is the only one of these cases which seems to afford an example of melanotic infiltration.

I shall here introduce a few cases that have been communicated to me, illustrating the occurrence of black expectoration, or of black deposition in the lungs, in individuals whose occupations did not appear to render them peculiarly liable to an accumulation of carbonaceous matter in the respiratory organs; and in whom, at the same time, there existed no traces of a melanotic diathesis. For the first of these, I am indebted to Dr. W. A. F. Browne, now of Montrose. "I find," says Dr. B., "that the only notes I possess

of the case of black expectoration, are as follows. 1832–3, I attended Mrs. C., Carrubbers Close, during the winter months. She complained of dyspnœa, and increased action of the heart. The former symptom, which had existed for some years, was invariably aggravated during the winter months and during the night. Regularly about four in the morning, she is obliged to rise and open the door of her room, which is subterranean. After any sudden exertion, fatigue, going up stairs or up the close, mental emotion, &c., the difficulty of breathing is increased, pain is felt in the epigastrium, and the palpitation is excessive. Morning headache; tongue loaded; bowels costive; countenance pale and dirty; sound on percussion dull over the whole of the left lung; the sonorous râle perceptible over the whole of the same side; action of the heart distinctly heard over the whole chest; she was leeched; a blister applied to the epigastrium, &c. From these measures relief was derived. After taking a mixture, she began to expectorate, which she had not hitherto done, and requested me to examine the clotted blood which, she affirmed, formed part of her sputa. This matter was suspended in the mucus, in the form of distinct masses; it was quite black; appeared to be enclosed within a capsule; and was dry and gritty. She said that she had observed it for some time. Imagining that it must be some soot or similar substance accidentally introduced, I requested her to spit into a tumbler containing water, and to keep all that she expectorated. Next morning, the quan-

tity of mucus was very great, and the black matter proportionally so. It presented the same characters. Many of the nuclei were as large as beans, and though not, as I imagined, surrounded by a capsule, the mucus in contact with them was dense and more inspissated than elsewhere. They varied in size from beans to pin-heads, and resembled in every respect, powdered charcoal. Mr. Kemp, Teacher of Chemistry, declared that the physical qualities of the substance indicated charcoal, but was prevented by accidental circumstances from analysing it. The patient is a native of Orkney, in coming from which, many years ago, she caught cold, and was afterwards subject to colds and rheumatism. She never was in a coal-pit nor lived in the neighbourhood of one; never was a charcoal-burner nor where it was made; in fact, was never exposed to any cause by means of which this black matter could be introduced from without. The dark coloured expectoration continued for about a month; it then became colourless, and afterwards ceased altogether. The woman is still alive, and although subject, during winter, to a return of dyspnœa, she is comparatively well, and has never since noticed any traces of the clotted blood."

A second case in which a considerable quantity of black matter was contained in the expectoration of an individual not habitually respiring an atmosphere loaded with particles of carbonaceous matter, forms part of a communication with which I have been obligingly favoured by Dr. Moir, of Musselburgh.

"The other case was in a gentleman, and of course where there was no exposure to the inhalation of either noxious particles or vapours, unless it might be of carbonic acid, as he was the proprietor of an extensive brewery, and in the daily habit of inspecting the tun-rooms, the large vats in which overflow with that deleterious gas. He was, moreover, of a delicate habit, and had been, for years, more or less subject to an affection resembling chronic pleuritis. The fatal attack made its approaches in hoarseness of voice, ending in aphonia, and in a feeling of constriction about the top of the larynx. These symptoms gradually yielded to topical bloodletting and the application of sinapisms; but in the course of a few weeks, were succeeded by the expectoration of a muco-purulent matter, which seemed to come from the trachea, and was brought up with little difficulty. When a severe fit of coughing came on, the discharge from the lungs was very different, there being little or no pus, but flakes of melanoid substance which stained the handkerchief, after a temporary decomposition, as if they had been composed of a mixture of mucilage and charcoal or soot. This species of expectoration continued till death, which took place under circumstances of extreme attenuation, the power of swallowing having been for several weeks almost lost, or the act accomplished with a convulsive effort, which appeared to result from the pressure of the substance swallowed upon some ulcerated surface about the top of the bronchiæ. I had no opportunity of *post mortem* examination."

The two next cases which I have to mention illustrate the deposition of black matter also in the lungs of persons not peculiarly exposed to the inhalation of carbonaceous vapours. In one of these the expectoration for some time previous to death gave indication of the condition of the lungs. In the other case, it does not appear that the sputa had exhibited any peculiarity of appearance.

Dr. Moir has favoured me with an account of the case of "a man, a little above fifty years of age, who had been for a considerable part of his life employed as a coachman; he had latterly got into rather intemperate habits, and for some time before his death was a day labourer; his first occupation in that way being in a quarry, and his last in breaking stones for the highway.

"His first symptoms nearly resembled those of asthma, and were very gradual in their progress; and it was not until œdema of the feet and hands, and other symptoms of general debility had presented themselves, that the occasional expectoration of a black sputum arrested my attention. Death was preceded by eight or ten days of extreme dyspnœa, and general livid appearance of the skin, caused by congestion in the capillaries.

"On dissection, I found the right lobe of the lungs comparatively sound, there being almost no traces of tubercular disease; but instead, I here and there came in my sections on little cysts, containing some an inky, and others a tarry fluid, in different degrees of inspissation, and which stained the fingers, as if

with soot or charcoal. It was in the left lung, however, that the greatest morbid change had taken place. At the lower portion of the lobe, it felt quite indurated to the touch; and, in external appearance, the whole mass looked as if it had been long soaked in ink. On being cut into, the induration was found to proceed from a species of hepatization, through which numerous cysts, as in the opposite side, were interspersed; and in the upper portion of the lung, where the induration had made less progress, these cysts were still larger and more numerous, and here and there the scalpel came in contact with concretions about the size of a pea, composed principally of a black carbonaceous matter. The lung on the left side partially adhered to the pleura at its upper and back portion. In both cavities there was a considerable deposition of transparent and nearly colourless serum."

The next case fell under the observation of Dr. Paul Veitch, to whom I am indebted for the following particulars:—

"I first visited Mrs. W. in the month of January 1836, and found her labouring under all the usual symptoms of chronic bronchitis, great emaciation, profuse night-sweats, quick, rapid pulse, about 130 in the minute, and very copious frothy expectoration, streaked with pus. She said she had the first attack of this ailment about seven years previously, and had attacks every winter till two or three years ago, when the cough and expectoration became constant. Loud sonorous râles were audible

over the whole chest. Under the usual remedies and sending her to the country, she became considerably better, and continued so till January 1837, when she had an attack of the epidemic influenza, by which she was much reduced, and she gradually sank till the 4th of April, when she died.

"*Dissection.*—On opening the thorax, the lungs were found adhering to the walls of the chest in every point, by old and very strong bands of false membranes. The right lung appeared of the usual size, but the left was collapsed, the bands being about an inch and a half in length. Both lungs were in the state of spurious melanosis, being darker and denser as we approached the superior lobes, but they were melanotic throughout*. The bronchial tubes were dilated, the mucous membrane thickened, and pus could be very copiously squeezed out from them. The left ventricle of the heart was a little thinner than usual, the free margin of the mitral valve removed by erosion, the orifices being contracted and open; the aortic orifice contracted. This woman's husband was a plasterer: she never lived in the neighbourhood of a coal-pit or iron work, and was in general in excellent health till she was attacked with the illness above alluded to, about eight years before her death."

I now proceed to lay before the Society some communications which we have received from gentlemen of great sagacity and of much experience in the dis-

* See preparation in the Museum of the Royal College of Surgeons of Edinburgh.

cases of the workmen employed in coal-mines, who have never observed, in that class of persons, appearances such as were described in my former communication. This may, no doubt, without disparagement to their accuracy of observation, be, in part at least, attributed to the circumstance of their attention not having been directed to the subject; but the experience of those who have paid much attention to it seems sufficiently to prove that, in the different mines which have fallen under their observation, there has been great diversity in the liability of the workmen to the black affection of the lungs.

To a communication addressed at an early period of this inquiry to Mr. John Wilson, of the house of Messrs. Wilson and Sons, who, in the various operations connected with the working of coal, limestone, ironstone and aluminous schistus, and the manufacture of alum at and near Hurlet, in the vicinity of Paisley, employ nearly 100 men *, my father received the following reply:

"West Hurlet,
19 April, 1833.

"I have given a copy of your queries to a medical friend of great experience, and I have conversed with him and with other intelligent persons in Glasgow and the surrounding country, and the results of my inquiries are that consumptions of the kind you describe do not exist among miners in this part of

* New Statistical Account of Scotland, No. XIV. p. 158, 9.

Scotland. My own experience, for above fifty years, entitles me to say that no diseases of this nature have been noticed among the miners here. They use considerable quantities of gunpowder in all their operations of blasting coal, limestone, and aluminous schistus, and no bad effects have been felt. Probably the disease you describe is local, or peculiar to some of the miners in the counties of Edinburgh and Fife."

In a communication from Dr. Macgowan, of Alloa, of date 28th of January 1834, that intelligent gentleman says,—"As far as I have been able to learn, no such disease as that which you describe, viz. a species of pulmonary consumption characterised by black mucous expectoration, ever appeared at the Alloa colliery, where there is a population of at least one thousand, and my late uncle, (Dr. Haig,) knew the work for nearly half a century. It is also, perhaps, remarkable that I have never seen a case of phthisis pulmonalis at the colliery during a period of six or seven years that I have been going about it. The workmen are entirely engaged in coal-mining. The bearer of this letter, Mr. Craich, is the resident manager at the works, and can of course inform you as to the nature of the atmosphere the men are exposed to in their operations."

Mr. Craich mentioned to me, in conversation, that during a long course of years that he has been attached to that colliery, he has not known more than two colliers who died of consumption, in fact,

fewer proportionally than of their relations who are employed above ground; whilst in other collieries in Fife, it is consistent with his knowledge that the miners die at an early period of life, and chiefly, as he believes, from consumption, but he cannot say whether attended with black spit or not.

In a letter to Dr. Simson, dated 6th September, 1834, Mr. Girdwood says,—"I attended the colliery at Kinnaird upwards of eight years, during which period about 150 people, young and old, were employed under ground, and not a single case of consumption occurred. Since 1826, Mr. Consbrough has attended the same colliery, and he informs me that no cases of consumption have taken place under his observation. At present only about 100 people are employed. About a hundred weight of gunpowder is weekly expended in this work. It is employed as well by the colliers as by those who are employed in making the roads. In the colliery of Carron Hall, between 200 and 300 are constantly employed, and gunpowder used in the same manner. Mr. Mitchell has attended it for fifteen years, and reports no case of consumption to have occurred during that period in any person employed under ground. Mr. Graham attends the Duke of Hamilton's colliery, where between 400 and 500 are employed. He concurs with Mr. Mitchell and Mr. Consbrough in stating that there is no case of phthisis in progress in a collier at present. Must it not, therefore, be rare amongst these people? I may observe that the colliers employed in the Kinnaird and Carron Hall works are

all descended from colliers from time immemorial. There is scarcely an instance of their intermarrying with other people, at least it is but rare."

There can be few authorities on a subject of this kind entitled to more consideration than the writer of the following letter, Dr. Headlam, of Newcastle, whether we consider the extent of opportunities of observation, or the capacity of profiting by them.

"March 22d, 1834.

"In answer to your queries relative to a peculiar form of consumption attended with 'black spit,' said to be prevalent among coal-miners, I have to say that I am not aware of the existence of such a disease in this neighbourhood. I have had during my professional career a very extensive experience in the chronic complaints of pitmen, and I am of opinion that this class of workmen are less subject than others to phthisis pulmonalis, which perhaps may partly depend upon their mode of life, their diet, and the temperature in which they live. Pitmen begin to labour early in life, marry soon, and pass much of their time, about eight hours in the day or night, under ground in a temperate or rather heated atmosphere. Their cottages, to which they return when their work is done, are generally warm and comfortable, and their diet is of the best kind with abundance of animal food and finest wheaten bread, unless their work is restricted by the state of the coal-trade. They are rather a small sized race, and are generally shortlived. They are frequently affected with dys-

pepsia and dyspnœa, which seem in many instances to be produced by the impurity of the air in the mines in which they work. The oppression of their chest and the prostration of their strength, which they feel in certain situations, are quickly relieved by removal to a better ventilated part of the mine.

"I have enquired of many medical practitioners who have had great experience in this neighbourhood, and I do not find that tubercular consumption with black spit has been noticed by them.

"I have in particular submitted your queries to Mr. James Nelson, of Chester, a very intelligent surgeon, who has had the most extensive practice among coal-miners in this district. He says that he knows no particular form of consumption to which colliers are subject, although they may suffer from dust inhaled into the lungs, like quarry men or razor grinders. In this way some have been affected with irritation upon the Schneiderian membrane, who are relieved for a time by removal to another pit where the ventilation is more perfect. This is not observed to be the case in one class of workmen more than in another, nor to be peculiar to the blasters. The complaint in the lungs of pitmen is of an asthmatic character, it occurs chiefly in the middle of life, and has not been observed to be attended with black discolouration of the sputa."

Dr. J. Stewart Thorburn, of Liverpool, in a letter dated 8th January, 1834, informed my father that he had learned from a most intelligent coal proprietor 2½ miles N. from Liverpool, that "in more than

twenty years' experience, he had neither heard of nor seen at any time, such a disease among his workmen as that described to him. He never knew of any chest affection proving fatal to them, with a single exception, that of a delicate girl in her teens, who died of pulmonary consumption of the ordinary characters. So far as his recollection goes, he never heard any workmen speak of a disease so very peculiar as that mentioned to him, as occurring in any coal-mine. According to his experience, coal-miners are very rarely affected with pulmonary disease. Coals of different kinds are obtained from his works, and one of these requires the use of gunpowder in blasting."

My intelligent young friend, Dr. Thomas Stratton, having gone in the course of last autumn to reside at North Shields, I requested of him to endeavour to ascertain whether the black pulmonary affection is known in the collieries of that district. In a letter with which he has favoured me, (dated 30th September, 1837,) he informs me that having made diligent inquiry on this subject during the previous month, the following are the results which he has obtained.

"In certain five collieries, employing in all 600 individuals, I could hear nothing of black expectoration. The miners themselves are sufficient authorities regarding their sputa, and the occurrence of black sputa was denied. The surgeons to several of the pits informed me that they had not seen any black expectoration, nor had any cases of black lung come under their observation.

"In two other collieries, employing 230 workpeople,

I could hear nothing of black expectoration from the miners, but the surgeon to these collieries informed me that he had observed it. He could not, however, furnish me with any farther particulars. He had not met with a case of black lung. I have enquired among workmen in iron foundries, &c., but have not discovered that they ever have black expectoration. I have also spoken to several of the medical men here, most likely to meet with such cases, and none of them have seen the black disease; one has observed black expectoration." Dr. Stratton then proceeds to inform me of the particulars of the examination of the body of a patient in the Tynemouth poorhouse, at which he had that day been present.

"*History of the patient.* G. H., a coal-miner, aged 70, worked in a coal-mine for 50 years; for the last four years has been an inmate of a poorhouse; he always enjoyed excellent health, and for thirty years was not ill for a single day. For some time before his death, he was under medical treatment, his symptoms being slightly pectoral, chiefly hepatic; he had ascites also and anasarca of the legs. His pectoral symptoms were those of chronic bronchitis; he did not expectorate much, and his sputa was never black.

"*Post mortem examination.* Both lungs presented a perfectly black appearance externally, and when cut into. A portion rubbed on the hand, left a black stain which was washed off with some difficulty, and a piece put into water, gave it the colour of china ink. Throughout both lungs were felt and

seen hard masses of black matter from the size of an almond downwards. These masses were more numerous in the middle lobe of the right lung and the middle part of the left lung, than in the upper and lower portions of either lung, and they were more abundant in the middle of the left, than in the corresponding part of the right lung. In the left lung were several chalky bodies encased in black matter. There was no black matter in the bronchial glands. There were extensive and firm adhesions of the left pleura. The heart natural. The liver and spleen were half their natural size. There was considerable ascites, the kidneys and intestines healthy."

Some ingenious remarks which Dr. S. has subjoined to his statement of this case, will find a place elsewhere. I hope the narration of it will induce practitioners in those coal districts in which black lung has not yet been observed, to keep a watchful eye on its occurrence.

APPENDIX OF WORKS REFERRED TO.

1. Coacæ Prænotiones. Edit. Foesii, 1657, I. 179 and 184.—2. Epistol. XXI. Art. 21.—3. Pharmaceutice Rationalis, Pars II. Sect. 1. Cap. 2. Engl. edit. p. 20; and ibid. Cap. 6; Engl. edit. p. 32.—4. Phthisiologia, 1689, p. 75.—5. Elementa Physiologiæ.—6. Treatise on the Asthma, 1786, p. 8, &c.—7. Mem. Acad. 1780. Anatomie Medicale. Phthisie Pulmonaire, II. 155.—8. Practical Inquiry into Disordered Respiration, (first published in 1797,) 4th edit. p. 130.—9. Philos. Trans. for 1813, p. 159.—10. Elemens de Pathologie Generale; Paris, 1817.—11. Auscultation Mediate.—12. Supplement à l'Histoire du Cœur, 1749, II. 687.—13. Prize Essay on the Structure, &c., of the Lungs, presented to the Berlin Academy of Sciences in 1806, and printed in 1808, p. 45.—14. Prize Essay, written on the same occasion, p. 111.—15. Anatome Corporis Humani, Lib. II.—16. Pathological Observations.—17. Epist. IV. art. 4.—18. Anatomie Gene-

rale, p. 605, 6.—19. Maladies de Poitrine.—20. Trans. of Med. Chir. Society of Edinb. Vol. I. p. 264. On Melanosis. By *Wm. Cullen and R. Carswell*, Esqs., p. 271.—21. Ibid., p. 275.—22. A Case of Melanosis, &c. By *Thomas Fawdington*; London, 1826.—23. *Laennec.* Traité de l'Auscultation Mediate.—24. *Schilling.* Diss. Inaug. de Melanosi; Francof., 1831, p. 44.—25. Ibid.—26. *Alibert.* Nosologie Naturelle, Vol. I. p. 553.—27. *Lobstein*, in Breschet's Repertoire Gen. d'Anatomie, Vol. VII. p. 48.—28. *Chomel.* Nouveau Journ. de Medec., Tom. III. p. 41.—29. *Lobstein.* Anatomie Pathologique, Tom. I. p. 461.

G. Woodfall, Printer, Angel Court, Skinner Street, London.

Gavard de Splachn. cases of Shit
inged with black. Chardel p. 182.
Henninger p. 110. Lorry ibid.
Jacobs de Melæna &c p. 111. (have)